(No Model.)

W. B. POTTER

ELECTRIC BRAKE.

No. 543,351. Patented July 23, 1895.

FIG. 1.

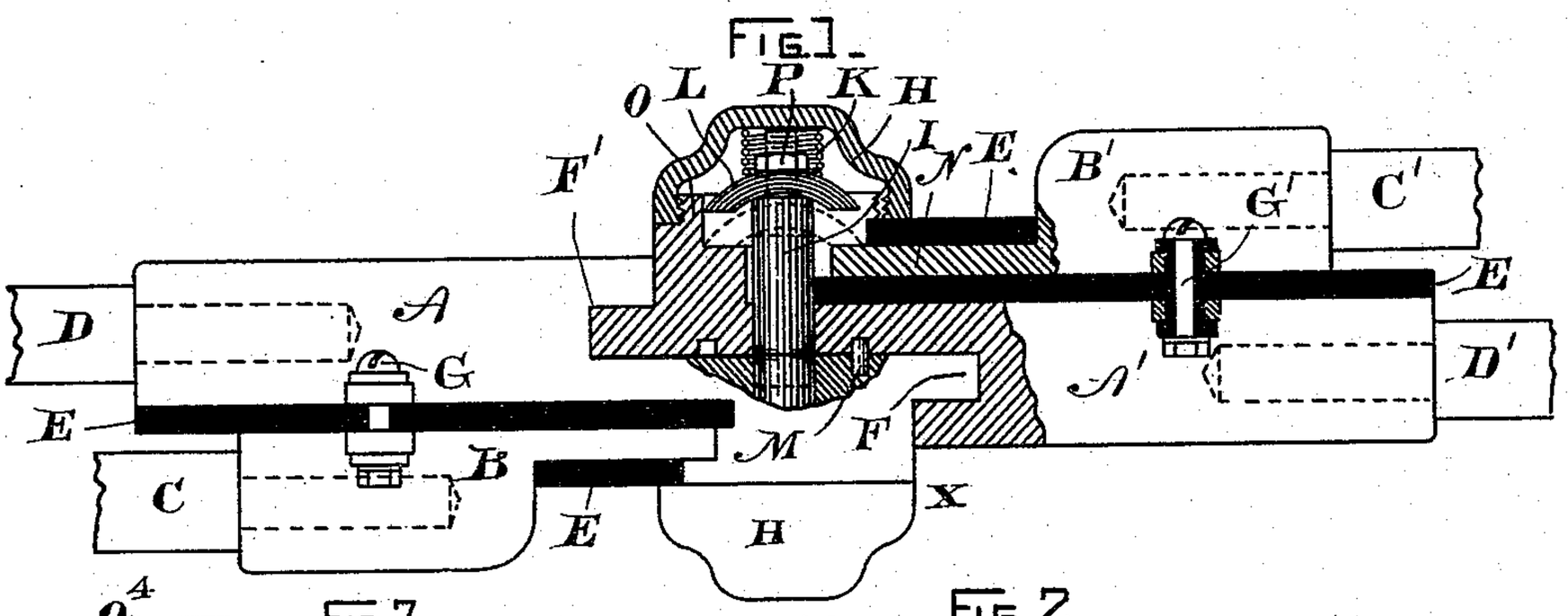


FIG. 7.

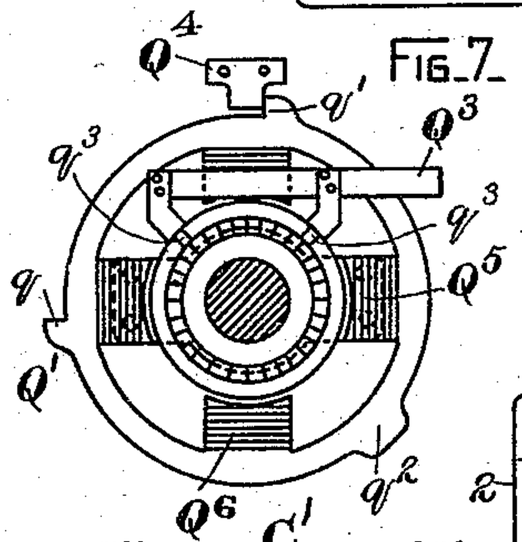


FIG. 2.

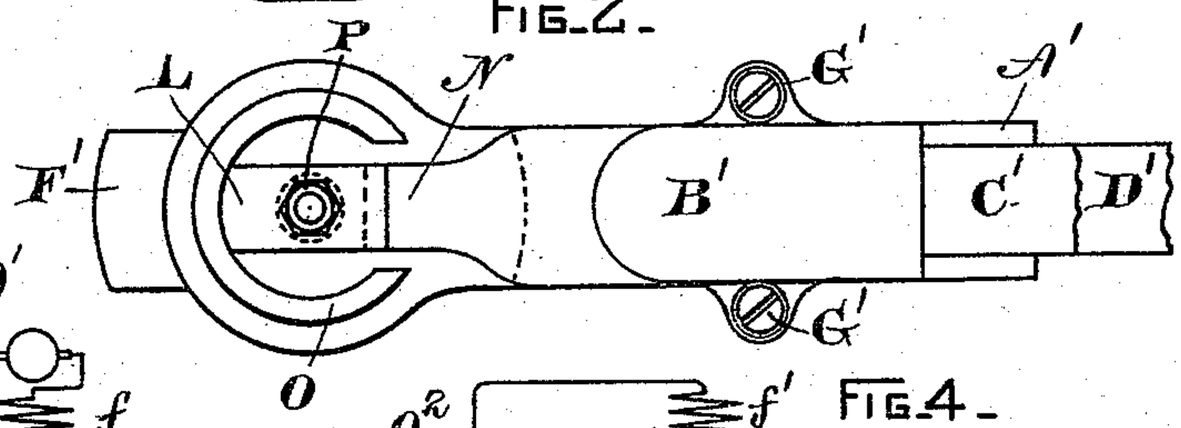


FIG. 3.

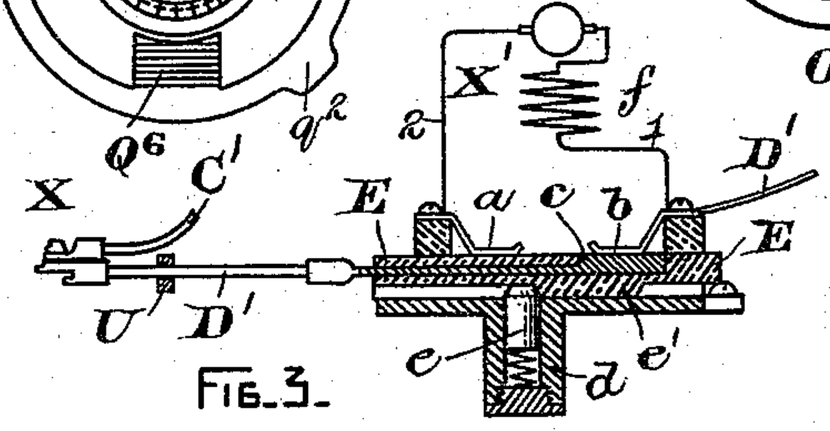


FIG. 4.

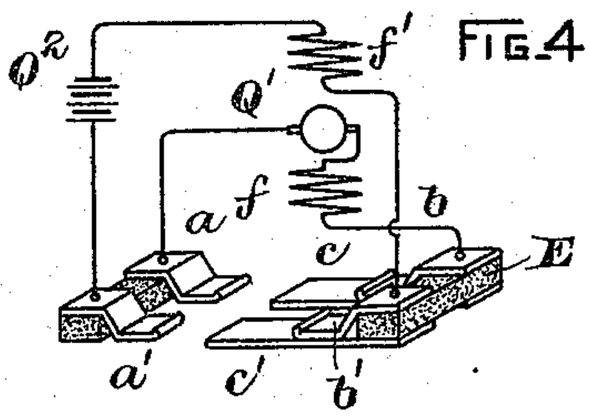


FIG. 5.

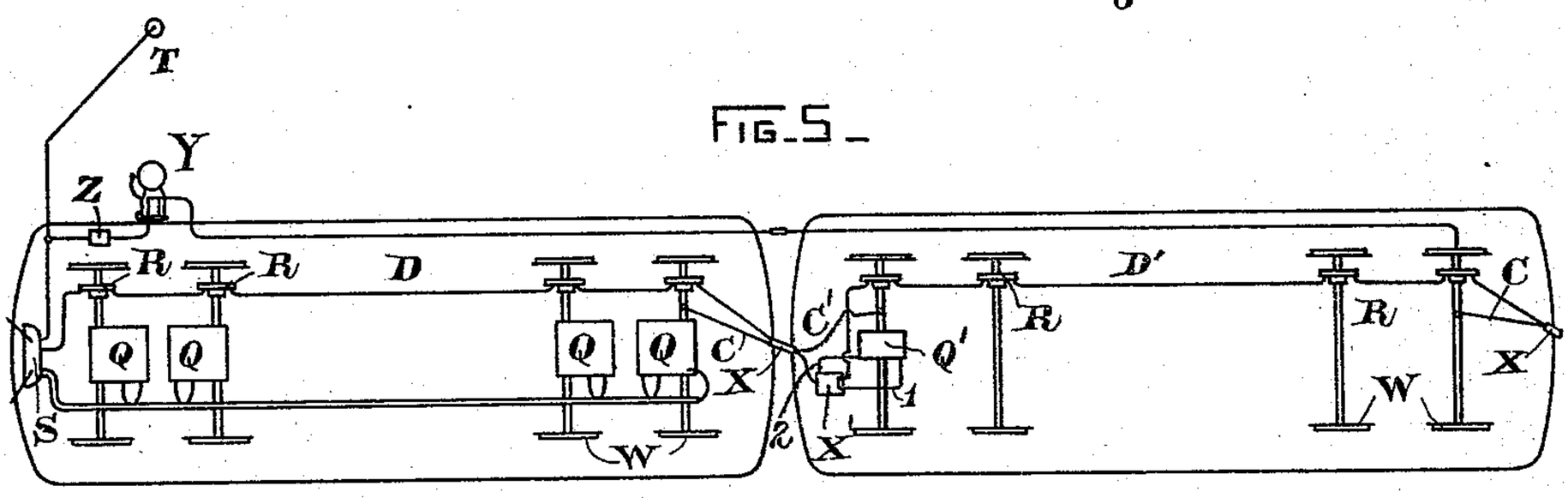
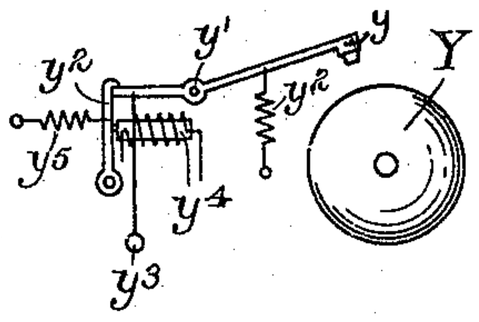


FIG. 6.



WITNESSES.

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UNITED STATES PATENT OFFICE.

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ELECTRIC BRAKE.

SPECIFICATION forming part of Letters Patent No. 543,351, dated July 23, 1895.

Application filed March 23, 1895. Serial No. 542,928. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM B. POTTER, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Electric Brakes, of which the following is a specification.

My invention relates to electric braking apparatus, particularly as applied to trains composed of a motor-car and a number of trailers or to a number of motor-cars and trailers combined, and has for its object to provide a safety appliance for such a combination of apparatus designed to prevent accident in case the train breaks in two.

In the operation of long-distance lines of any kind it is imperative that the rear portion of the train which is accidentally broken shall be stopped or so materially retarded as to avoid any danger of collision with the front part when that part is brought to a standstill by the engineer. The ordinary air-brake or other fluid-pressure brake in use upon a steam-actuated railway-train provides for this emergency by exhausting the train-pipe and turning on the pressure from the auxiliary reservoirs whenever the train is accidentally severed. The forward part of the train remaining under the engineer's control may be drawn away from the part in the rear at any desirable rate of speed, but where the train is upon a downgrade unless the rear part is checked it may run away and collide with the front portion, or if it be on the upgrade it may run away backward. It is to prevent similar mishaps to electric trains and to provide analogous means of control that I have devised my invention, which consists, first, in so coupling the cars that by the rupture of the coupling a circuit will be completed through the brake-magnets upon the portion of the train separated from the motors. To provide current for this circuit I equip each car which has no motors with a small generator, the armature of which is carried directly upon the axle. By preference I make the field-magnets of this generator of hardened steel, so that considerable residual magnetism will be retained even after the lapse of time and the ordinary shocks and jars of railway travel. This generator may be and preferably is of small size, inasmuch as it will be driven with considerable speed, and its magnetism, which will be furnished by a series field, is carried to a high point. I also so arrange the coupling of the generator in this connection that at the moment of rupture of the coupling the generator will be short-circuited for an instant, and thus a very high charge of current will pass through the field-magnets and develop an initial field. As a modification of this portion of my invention I may also provide for an initial excitation by means of a small battery, primary or secondary. For the small generator any suitable source of electromotive force may be substituted, although ordinarily the generator will be found most desirable commercially.

Another feature of my invention consists of means for notifying the engineer of any break in the train. This consists of a gong in the trolley-circuit, or, rather in a shunt from the trolley-circuit to ground, the shunt being made of very high resistance, so that the current is limited to a very small amount. The bell is so arranged that so long as the current is on the hammer is held away from the gong, but upon cessation of the current the gong will ring. The coupling for this circuit is so arranged that the circuit is carried through to the last car of the train, but upon the breaking of the connections the circuit will be broken. It is of course to be understood that the circuit is from the trolley to ground, for which purpose the running-gear on the last car will be utilized.

My invention further consists in the details of the form of coupling which I employ to carry out this purpose, and in other details and combinations which will be fully pointed out hereinafter.

The accompanying drawings show embodiments of my invention, Figure 1 being a side elevation, partly in section, of the improved coupling which I employ; Fig. 2, a plan view of one member of the coupling. Fig. 3 is a detail showing the means for momentarily short-circuiting the generator. Fig. 4 is a modified form, partly diagrammatic and partly perspective, of the arrangement shown in Fig. 3. Fig. 5 is a diagrammatic plan view of a train equipped with my apparatus. Fig. 6 is a detail of the arrangement of gong in

the alarm-circuit, and Fig. 7 shows an automatic reverse more fully described hereafter.

Referring by letter, A is one of the parts of the coupling to which I have referred, which I have designated as a whole by the letter X. B is another part, each of the parts A and B being provided with means for attaching the cables C D. The two parts are insulated from each other by interposed sheets of hard rubber or other suitable insulation E, and are held together by screws G, only two of which are shown in Fig. 1. The parts on the right of the coupling are identical with those on the left, it being interchangeable and are marked with the letters A′, G′, &c.

F F′ are the projecting contacts of the metallic parts A A′, respectively, designed to complete the circuit. It is understood that ordinarily the circuit is completed from the cable D to the cable D′ through the parts A A′, but upon the interruption of the circuit contact is made between the parts A B, and A′ B′, respectively, and the cables D C, and D′ C′ are connected. The means for establishing this latter connection is shown in section in Fig. 1. Therein H is a cap inclosing a sliding bolt I, carrying a bridge-piece L, which may be made of a single piece of metal, but which I prefer to make, as illustrated, in the form of an arch of several pieces of flexible metal to insure a good contact. This bridge-piece is held upon the bolt or stud by a lock-nut P, and a spring K acts to force it down into contact when the coupling is broken. Part of the metal of the coupling is formed into a ring or flange O, (best seen in Fig. 2,) and provided with a screw-thread upon which the nut H is secured.

N is a small projecting portion of the part B′ of the coupling not protected by the insulation, and affording contact with the bridging-piece L.

At M, I show a pin in one coupling registering with a groove in the other.

It is to be understood that the two parts of the coupling are applied ordinarily at an angle and are then brought into alignment, this action making the pin M engage with the groove. The shearing strength of the pin M is less than the strength of the joint between the cables C D and the parts A B, respectively, so that in the event of a rupture of the train the cables will not be torn apart, but the pin M will be broken. The surfaces of the coupling afford ample contact area for the transmission of any current which the cables are sufficient to carry.

The parts shown in Fig. 2 are sufficiently described in connection with Fig. 1.

In Figs. 3 and 4 I show the arrangement by which an initial charge or excitation is given to the small generator operating the brake on the part of the train separated from the motor-car.

Referring first to Fig. 3, X is, as before, the main coupling. (Illustrated in Fig. 1.) C′ D′ are cables extending therefrom, the right-hand half of the coupling being shown. E E is a body of insulating material, carrying in it a small metallic piece *c*, which forms a bridging-contact between the flexible contacts *a b*. In the tube *d* is mounted a tumbler *e*, slightly beveled at its top end and engaging with the bridging portion *e′* of the insulating-piece E E. *f* is the field of the generator Q′, carried upon the axle of the truck. At U, I provide a stop which prevents the destruction of the auxiliary coupling. The office of the tumbler *e* is to prevent the insulating-slide carrying the contact *c* from being drawn with any little strain which may happen to occur, it taking considerable force to pull the slide, but after the part *e′* has passed the tumbler the slide cannot be pushed in accidentally.

The operation of the device just described is as follows: When the coupling X is ruptured, the pull of the cable E′ pulls out the slide E, carrying the contact *c* past the tumbler *e*, which then locks it in position. The contacts *a b* are thus momentarily short-circuited, and the initial charge is passed through the field-magnet *f*. The magnetism rapidly runs up and current is sent out to the brake-magnets on the car, as will be more fully described in referring to Fig. 5. It is of course to be observed that the generator Q′ is normally open-circuited, so as to prevent the operation of the brake in ordinary handling of the car.

Referring now to Fig. 4, I illustrate substantially the same combination of parts, except that I provide, also, auxiliary contacts *a′ b′*, which are connected by an auxiliary movable contact *c′*. The field of the generator Q′ is divided for purposes of illustration. A few cells of storage battery or other source of electromotive force are coupled to the auxiliary contacts, and the portion *f′* of the field is placed in circuit by connecting these contacts. The operation of this device is the same as that described with reference to Fig. 3. It is of course possible, however, and would ordinarily be preferable to connect the storage-battery directly to the series field of the generator.

In Fig. 6 I show the automatic alarm. This consists of a single-stroke gong Y. The hammer *y* is pivoted at *y′* and held in place by a pawl y^2. This pawl acts as the armature to an electromagnet y^4, which attracts the pawl against the pull of the spring y^5, a similar spring y^2 engaging the hammer when the pawl is released. A handle Y^3 is provided by which the hammer may be restored to place after its stroke. The operation of these parts will be described in referring to Fig. 5, which is a general view of the system.

In Fig. 5, S is the controller. Q Q, &c., are the motors; W W, the wheels of the car. R R are the brake-magnets. Z is a resistance in the shunt-circuit of the bell Y, designed to limit the current. This shunt-circuit is carried, ordinarily, to the rear of the train and grounded upon one of the axles of the rear

coach. The current passes from the trolley T through the shunt and through the bell and energizes the electromagnet y^4 to hold the pawl y^2 in place. In the event of the coupling between the cars breaking the shunt is also broken and the circuit interrupted. The current in the electromagnet falls off, the pawl is drawn back by the spring y^5, and the hammer y strikes the bell. Upon the circuit being again made the handle y^3 is pulled and the hammer drawn back to place. When the train is broken by the rupture of the coupling, the electrical coupling X is also broken, the coupling shown in Fig. 3 or that shown in Fig. 4 (indicated at X′ in Fig. 5) is operated, the generator Q′ is momentarily short-circuited, the current passing along the line l to the coupling X′, thence through the short-circuiting contacts upon that coupling to the lead 2 and back to the generator The contact c, however, immediately passes off the contact b, and the circuit is then to the cable D′, Fig. 3, thence to the cable C′ and to ground, the circuit from the other side of the generator passing through the coupling X′ to the brake-magnets and to ground at the rear of the car in Fig. 5. The operation in the same relation of the parts shown in Fig. 4 will be understood without further description.

As thus far described and illustrated, my improved apparatus would operate only when running on one direction—that is, forward, or to the left in Fig. 5. As this would, however, prevent its operation in case the rear end of the train should break off when running up grade, so that the car would first come to a stop and then run away backward, I provide means for insuring a supply of current from the auxiliary generator Q′, in whichever way the train may be moving, and the means preferred is illustrated in Fig. 7. Briefly, the arrangement consists in mounting the field-magnets of the generator upon the axle by a bearing of slight friction, just sufficient to insure their being turned in the direction in which the axle is turning until arrested by a suitable stop on the frame. I thus provide for reversing the relation of the armature and field by shifting the field in relation to the commutator-brushes, and in whichever direction the armature shall revolve it will generate current.

In Fig. 7 Q′ is, as before, the generator as a whole; Q^6, its field-magnets, illustrated as of the four-pole type. Q^3 is the brush-holder yoke attached to any suitable fixed support, and Q^4 is a stop also attached to a fixed support, as any part of the truck-frame. $q\ q'$ are lugs upon the outer frame of the field-magnets designed to co-operate with the fixed part or stop Q^4. $q^3\ q^3$ are the brushes bearing upon the commutator. q^2 is a counterbalance for the lugs $q\ q'$, and Q^5 is a suitable yoke supported by bearings (not illustrated, but of any suitable form) upon the axle.

It is also manifest that any suitable means may be adopted for so adjusting the relation of armature and field as to render the apparatus operative in whichever direction the car may move.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In combination, an electric motor car, a trailer attached thereto, braking apparatus upon both cars normally actuated by the motors upon the motor car when operated as generators, an auxiliary normally idle source of electro-motive force carried upon the trailer, and means whereby the auxiliary generator is thrown into closed circuit with the braking magnets upon the trailer by the accidental separation of the trailer from the motor car.

2. In combination, an electric motor car, a trailer, braking apparatus upon the two cars and normally operated by the motors upon the motor car when operating as generators, an auxiliary normally idle dynamo-electric generator carried upon or driven by the axle of the trailer, and suitable couplings and connections between the braking apparatus and the auxiliary generator whereby the accidental separation of the connection between the motor car and trailer acts to set the brake upon the trailer.

3. In combination, an electric motor car, a trailer, an auxiliary normally idle dynamo-electric machine upon the trailer car, and means whereby the accidental separation of the two cars will close the auxiliary generator upon a local circuit acting to stop the trailer car.

4. In combination, an electric motor car, a trailer, braking apparatus upon the two cars normally operated by the motors upon the motor car when acting as generators, an auxiliary normally idle dynamo-electric machine upon the trailer car, and means whereby the accidental separation of the two cars will first momentarily short-circuit the auxiliary machine and then throw it upon a local circuit including the brake magnets.

5. In combination, an electric motor car, a trailer, braking apparatus upon the two cars normally operated by the motors upon the motor car when acting as generators, an auxiliary normally idle dynamo-electric machine upon the trailer, and means for causing the accidental separation of the two cars to impart an initial excitation to the field-magnets of the auxiliary machine, and then throw it upon a local circuit including the braking apparatus of the trailer.

6. In combination, an electric motor car, a trailer, braking apparatus upon the two cars normally actuated by the motors upon the motor car when operating as generators, an auxiliary normally idle dynamo-electric machine upon the trailer, contacts and connections whereby the auxiliary machine is first momentarily short-circuited to obtain an initial field-magnetization and is then thrown upon a local circuit including the braking ap-

paratus upon the trailer, and means for preventing the accidental displacement of the contacts and connections.

7. As a means for arresting a moving vehicle, a normally idle dynamo-electric generator thereon, braking apparatus, means for imparting an initial magnetization to the generator, a local circuit, and means for including the generator in the local circuit with the braking apparatus.

8. In an electric braking apparatus, a dynamo-electric generator composed of an armature mounted upon the axle of the vehicle, a field-magnet also rotatably mounted upon such axle, and a stop limiting the motion of the field-magnet in either direction; whereby the relation of the field-magnet and armature may be reversed to correspond to the direction of motion of the car.

9. As a means for arresting a moving vehicle, a normally idle dynamo-electric generator thereon, braking apparatus, means for throwing the generator into a local circuit including the braking apparatus, and means for adjusting the relation of armature and field in accordance with the direction of motion of the vehicle.

In witness whereof I have hereunto set my hand this 22d day of March, 1895.

WILLIAM B. POTTER.

Witnesses:
B. B. HULL,
A. F. MACDONALD.